Enhanced Water Quality Monitoring and Modeling Program for the A.R.M. Loxahatchee National Wildlife Refuge Quarterly Update Report – April 2011

Prepared by:
Donatto Surratt, A.R.M. Loxahatchee National Wildlife Refuge

With contributions from Mike Waldon

Overview

This update is a summary of activities since the previous status report of January 2011 on the implementation of the Refuge's Enhanced Water Quality Monitoring and Modeling Program. A project overview, and other detailed information about the program can be found at: http://sofia.usgs.gov/lox_monitor_model/. The primary objective of this overall program (Brandt et al. 2004) focuses on providing information for use in ecological management of the Refuge (e.g., USFWS 2007a, b).

The Refuge's monitoring component of this program also addresses one of the Consent Decree Principals recommendations (17 December 2003):

> ***B. Enhancing Monitoring of the Refuge***
> *Design and implement an enhanced monitoring program to improve spatial and temporal understanding of factors related to phosphorus dynamics.*

The Refuge's modeling component of this program also addresses several of the Consent Decree Principals recommendations (17 December 2003):

> ***C. Modeling of the Refuge***
> *1. Develop a water quality/hydraulic model for the Refuge with a phosphorus cycling component.*
> *2. Evaluate issues associated with phosphorus loads and transports within the L-40 and L-7 canals.*
> *3. Develop and track a simple phosphorus mass-balance model for the Refuge.*

Information Availability

Through collaboration with USGS, information from the Refuge's Enhanced Water Quality Monitoring and Modeling Program has been made available on the USGS' SOFIA web site at: http://sofia.usgs.gov/lox_monitor_model/.

Final data for monthly samples through May 2006 are publicly posted on DBHYDRO by the SFWMD at http://my.sfwmd.gov/dbhydroplsql/show_dbkey_info.main_page. Data for June 2006-December 2010 are posted on the Technical Oversight Committee's web site at https://my.sfwmd.gov/portal/page/portal/pg_grp_sfwmd_era/pg_sfwmd_era_techovercommittee. This report includes information from samples collected through December 2010.

Water Quality Data Analyses Update

Primary efforts for this quarter involved exploring mechanisms to continue translating information from the program to aid in Refuge management decisions, and working on the program's Annual Report.

Monitoring Update (January 2011 – March 2011)

Sampling of the enhanced water quality monitoring network (**Figure 1**) occurred at 23 stations in January, 21 stations in February and all 9 stations in March 2011 (**Table 1**).

Total phosphorus data available to date for April 2010 through March 2011 are presented in **Table 1**. Maps of stations where samples were collected for January through March 2011 are presented in **Figures 2-4**.

Conductivity sonde deployment information for April 2010 through March 2011 is presented in **Table 2**.

Modeling Update

During the first quarter of 2011, the Refuge modeling team began a study to compare performance of the 39-box Refuge model with the MIKE-FLOOD Refuge model. We plan to use this comparison to guide model selection for future applications. We anticipate that this work will also be reported in a journal publication. Efforts continued on models documentation and journals publications development. A report on the MIKE-FLOOD model of stage and chloride was finalized.

Next Steps

The next steps for this program include additional efforts on the Annual Report, and additional model development and application.

References

Brandt, L.A., Harwell, M., Waldon, M. (2004) Work Plan: Water Quality Monitoring and Modeling for the A.R.M. Loxahatchee National Wildlife Refuge: 2004-2006. Prepared for the A.R.M. Loxahatchee National Wildlife Refuge. April, 2004. 33 pp.

USFWS. (2007a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Monitoring and Modeling Program – 2nd Annual Report – February 2007. LOXA06-008, U.S. Fish and Wildlife Service, Boynton Beach, FL. 183 pp.

USFWS. (2007b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 3rd Annual Report – October 2007. LOXA07-005, U.S. Fish and Wildlife Service, Boynton Beach, FL. 116 pp.

USFWS. (2009) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 4th Annual Report – July 2009. LOXA09-007, U.S. Fish and Wildlife Service, Boynton Beach, FL. 106 pp.

Table 1. Total phosphorus data (ppb) available for April 2010 – March 2011 from the Enhanced Water Quality Monitoring Program for: (a) marsh, and (b) canal stations for the A.R.M. Loxahatchee National Wildlife Refuge. Graphical representation of station locations are shown in Figure 1.

a) Marsh stations

Marsh Station	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11
LOXA101	9	-	14	-	32	22	16	14	20	12	-	-
LOXA102	-	-	-	-	-	16	12	8	-	-	-	-
LOXA103	-	-	-	-	-	20	12	10	10	-	-	-
LOXA105	8	-	20	19	24	26	21	16	8	-	-	-
LOXA106	5	-	11	15	14	15	16	9	3	-	-	-
LOXA107	-	-	-	-	-	19	13	9	-	-	-	-
LOXA108	U	-	6	7	-	9	8	5	9	-	-	-
LOXA109	4	10	11	9	10	11	11	7	3	7	8	-
LOXA110	7	10	10	10	10	7	10	8	6	-	-	-
LOXA111	3	8	5	6	8	7	9	6	U	41	10	51
LOXA112	U	6	11	17	11	10	10	7	5	-	-	-
LOXA113	U	6	U	5	8	5	10	5	6	4	-	-
LOXA114	U	7	6	8	6	5	12	U	U	5	-	-
LOXA117	5	10	14	28	17	33	22	15	9	12	14	-
LOXA118	2	10	10	10	11	11	13	9	6	7	9	-
LOXA119	4	8	8	9	9	7	12	7	5	14	17	-
LOXA120	3	6	7	7	7	4	8	7	5	6	10	13
LOXA122	6	15	19	18	17	21	19	13	9	13	13	-
LOXA124	9	9	18	16	13	18	13	10	14	7	15	-
LOXA126	3	12	14	18	18	20	13	12	16	5	7	-
LOXA127	U	7	-	18	12	9	7	8	11	-	9	-
LOXA128	2	5	U	6	7	4	9	4	U	-	-	-
LOXA130	3	11	13	14	8	26	15	11	14	5	13	21
LOXA131	U	8	8	13	12	11	9	7	9	5	9	-
LOXA133	14	-	30	-	17	46	20	15	28	-	-	-
LOXA134	5	9	11	13	11	21	16	11	11	5	12	-
LOXA136	7	22	18	-	-	33	23	-	21	11	17	-
LOXA137	6	12	9	8	8	18	17	11	12	11	14	-
LOXA138	U	7	10	7	8	9	17	6	8	-	-	-
LOXA139	4	11	6	9	6	7	7	8	9	-	-	-
LOXA140	10	9	11	-	10	18	12	11	16	-	-	-
LOXA141	10	15	10	12	13	13	20	15	10	11	61	12
MAX	14	22	30	28	32	46	23	16	28	41	61	51
MIN	2	5	5	5	6	4	7	4	3	4	7	12

U indicates that compound was analyzed, but the concentration was below the minimum detection limit.

Table 1 cont.

b) Canal stations

Canal Station	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11
LOXA104	56	42	26	26	34	31	27	28	20	21	29	32
LOXA115	37	36	29	23	34	33	30	27	23	20	22	23
LOXA129	70	49	59	39	37	32	28	28	25	30	41	63
LOXA132	71	51	53	60	36	38	29	30	26	39	43	59
LOXA135	72	46	51	62	32	20	21	27	28	32	33	46
MAX	72	51	59	62	37	38	30	30	28	39	43	63
MIN	37	36	26	23	32	20	21	27	20	20	22	23

U indicates that compound was analyzed, but the concentration was below the minimum detection limit.

Table 2. April 2010 – March 2011 conductivity sonde deployment information, separated by transect, for the A.R.M. Loxahatchee National Wildlife Refuge. X = data collected from sonde deployment during that month. Graphical representation of station locations are shown in Figure 1.

	2010									2011		
Site ID	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
LOXA104	X	X	X	X	X	X	X	X	X	X	X	X
LOXA105		X	X	X		X		X		X		X
LOXA106		X	X	X		X		X		X		X
LOXA107		X	X	X		X		X		X		X
LOXA108		X	X	X		X		X		X		X
LOXA111	X		X		X		X		X		X	
LOXA112	X		X		X		X		X		X	
LOXA113	X		X		X		X		X		X	
LOXA114	X		X		X		X		X		X	
LOXA115		X	X	X	X	X	X	X	X	X	X	X
LOXA116		X	X	X		X	X		X		X	X
LOXA117		X	X	X		X	X		X		X	X
LOXA118		X	X	X		X	X		X		X	X
LOXA119		X	X	X		X	X		X		X	X
LOXA120		X	X	X		X	X		X		X	X
LOXA126	X		X		X		X		X		X	
LOXA127	X		X		X		X		X		X	
LOXA128	X		X		X		X		X		X	
LOXA129		X	X	X	X	X	X	X	X	X	X	X
LOXA130		X	X			X		X		X		X
LOXA131		X	X			X		X		X		X
LOXA132		X	X	X	X	X	X	X	X	X	X	X
LOXA133		X	X			X		X		X		X
LOXA135		X	X	X	X	X	X	X	X	X	X	X
LOXA136		X	X			X		X		X		X
LOXA137		X	X			X		X		X		X
LOXA138		X	X			X		X		X		X
LOXA139		X	X			X		X		X		X
LOXA142		X		X		X		X	X		X	
LOXA143	X		X		X		X		X		X	X
LOXA144	X		X		X		X		X		X	X
LOXA145	X		X		X		X		X		X	X
LOXA146	X		X		X		X		X		X	X
LOXA147		X		X							X	X
LOXA148	X		X		X		X		X		X	X
LOXA149	X		X		X		X		X		X	X
LOXA150	X		X		X		X		X		X	X
LOXA151		X	X	X	X	X	X	X	X	X	X	X
LOXA152		X	X	X	X	X	X	X	X	X	X	X
LOXA153		X	X	X	X	X	X	X	X	X	X	X
I-8C	X		X	X	X	X		X		X	X	X
LOX04		X	X			X		X		X		X
LOX06	X		X		X		X		X		X	
LOX07	X		X		X		X		X		X	
LOX08	X		X		X		X		X		X	
LOX09	X		X		X		X		X		X	
LOX10	X		X		X		X		X		X	
LOX15	X		X		X		X		X		X	X

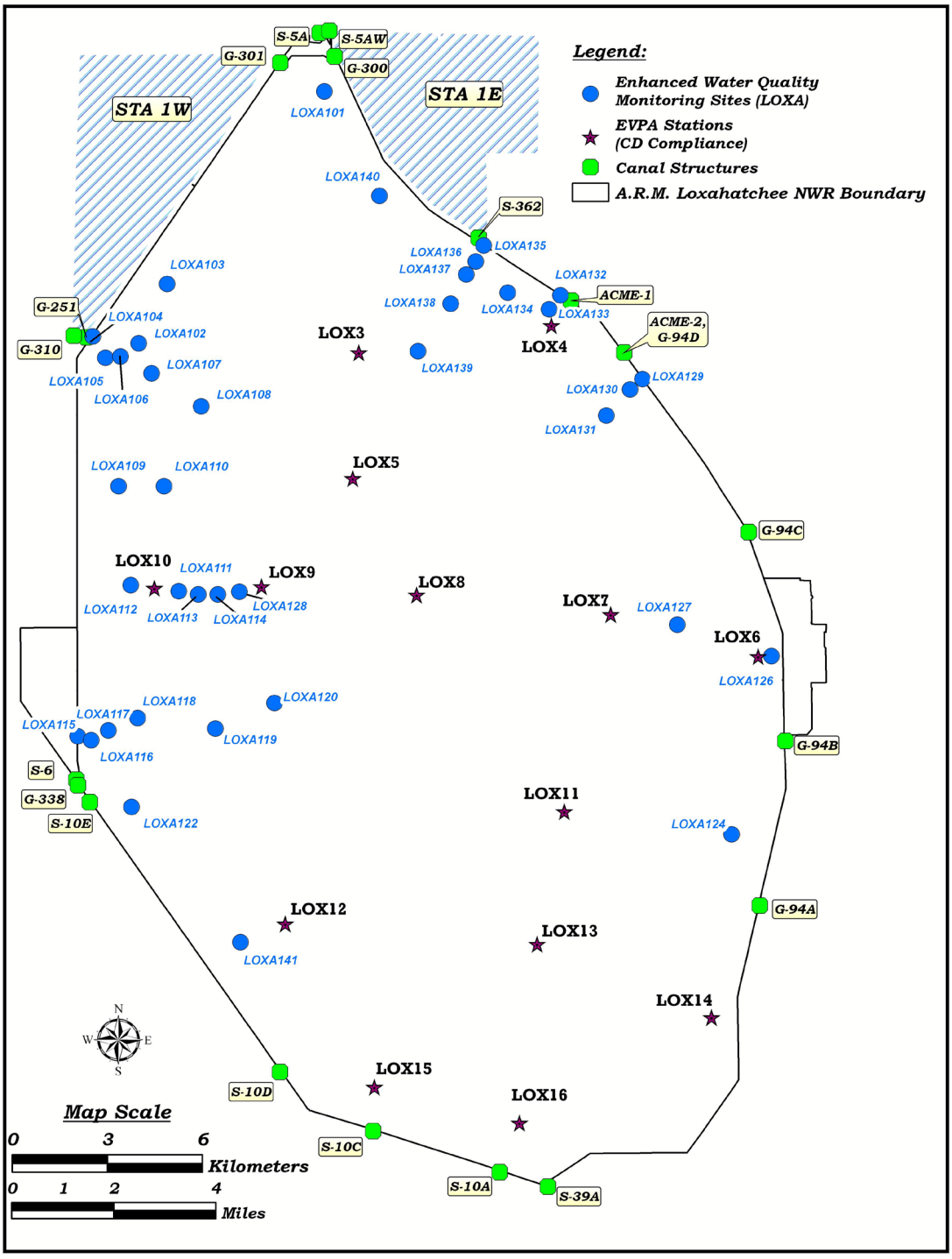

Figure 1. Location of Enhanced Water Quality Monitoring network stations (LOXA###), in relation to Consent Decree compliance stations (LOX##), for the A.R.M. Loxahatchee National Wildlife Refuge.

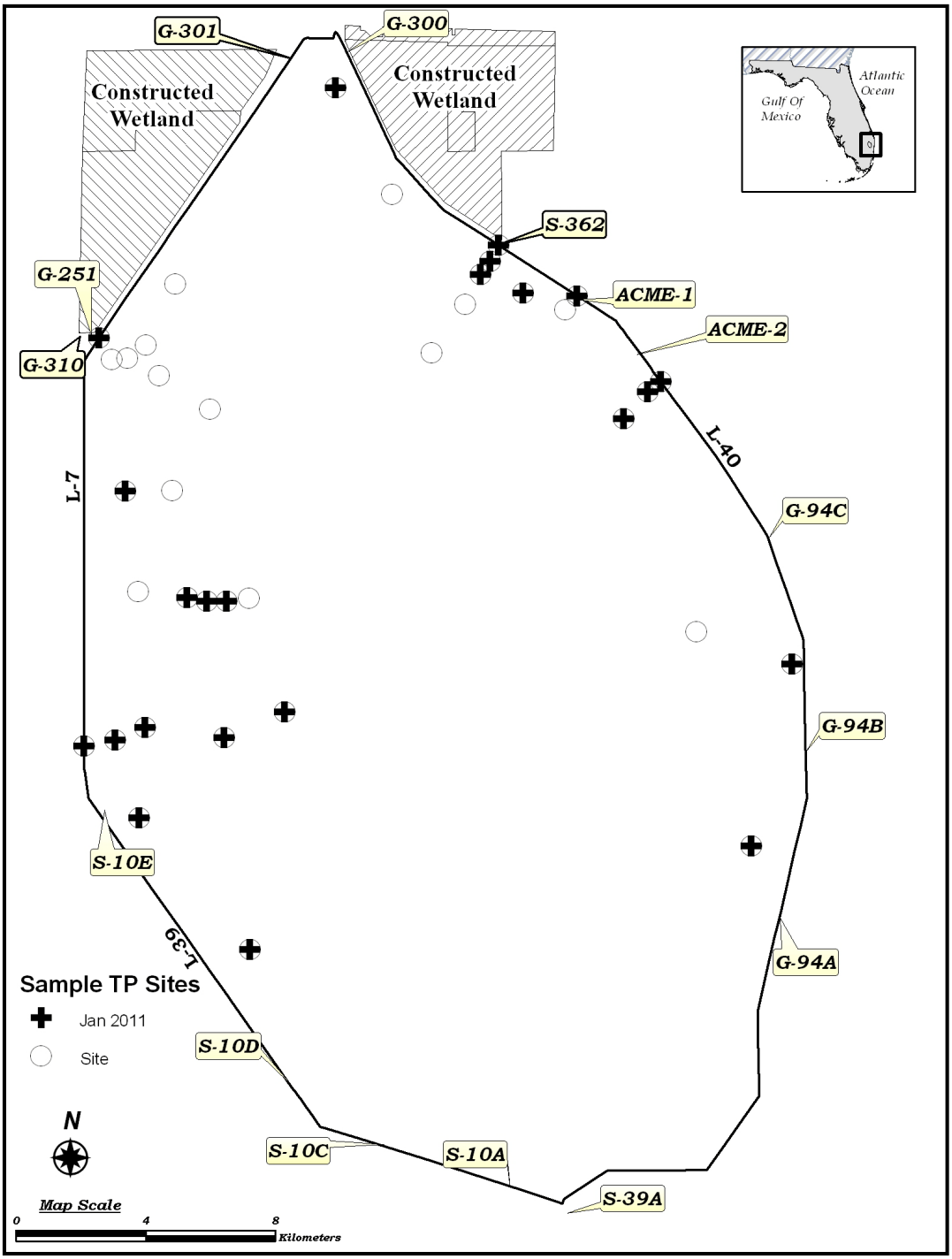

Figure 2. January 2011 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

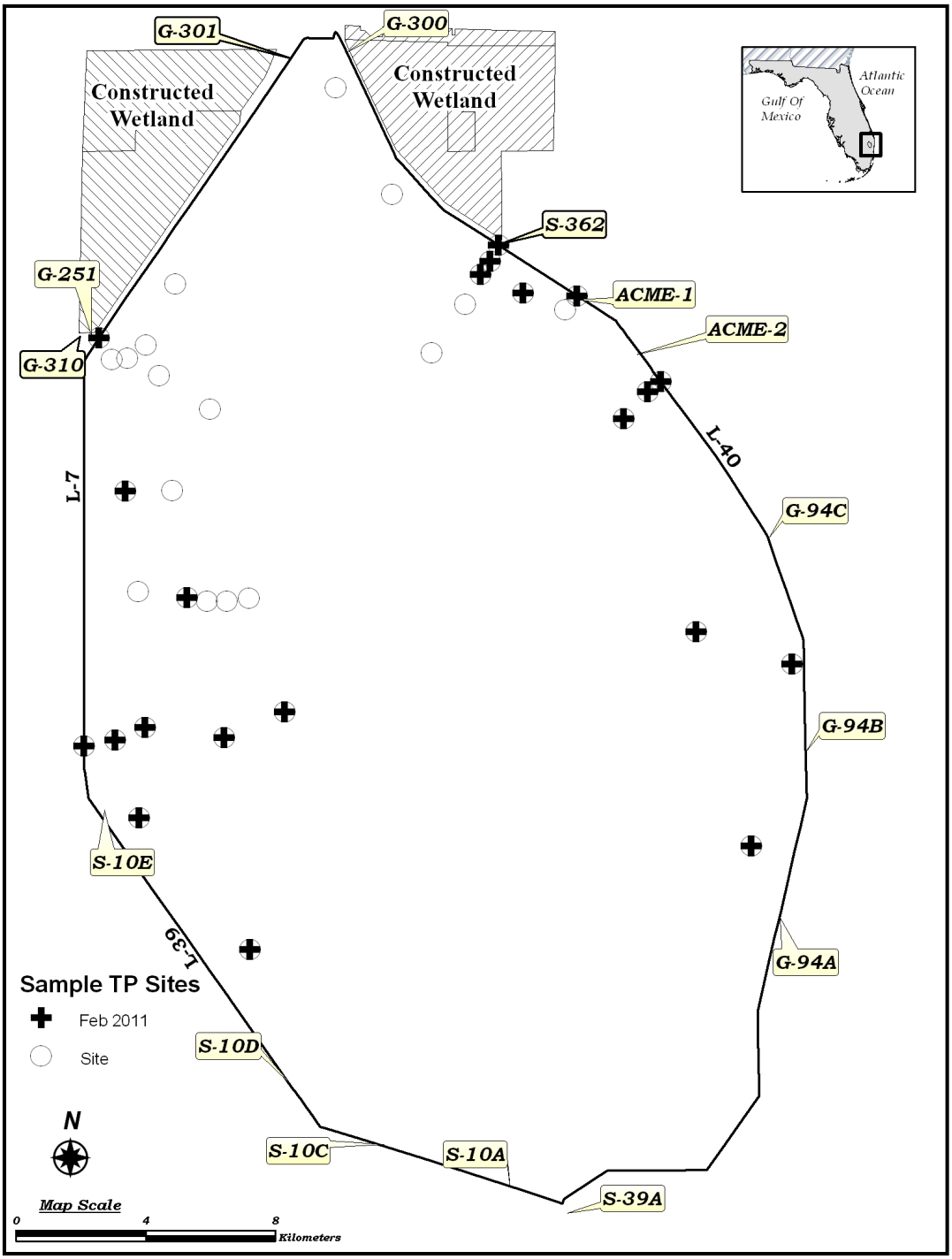

Figure 3. February 2011 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

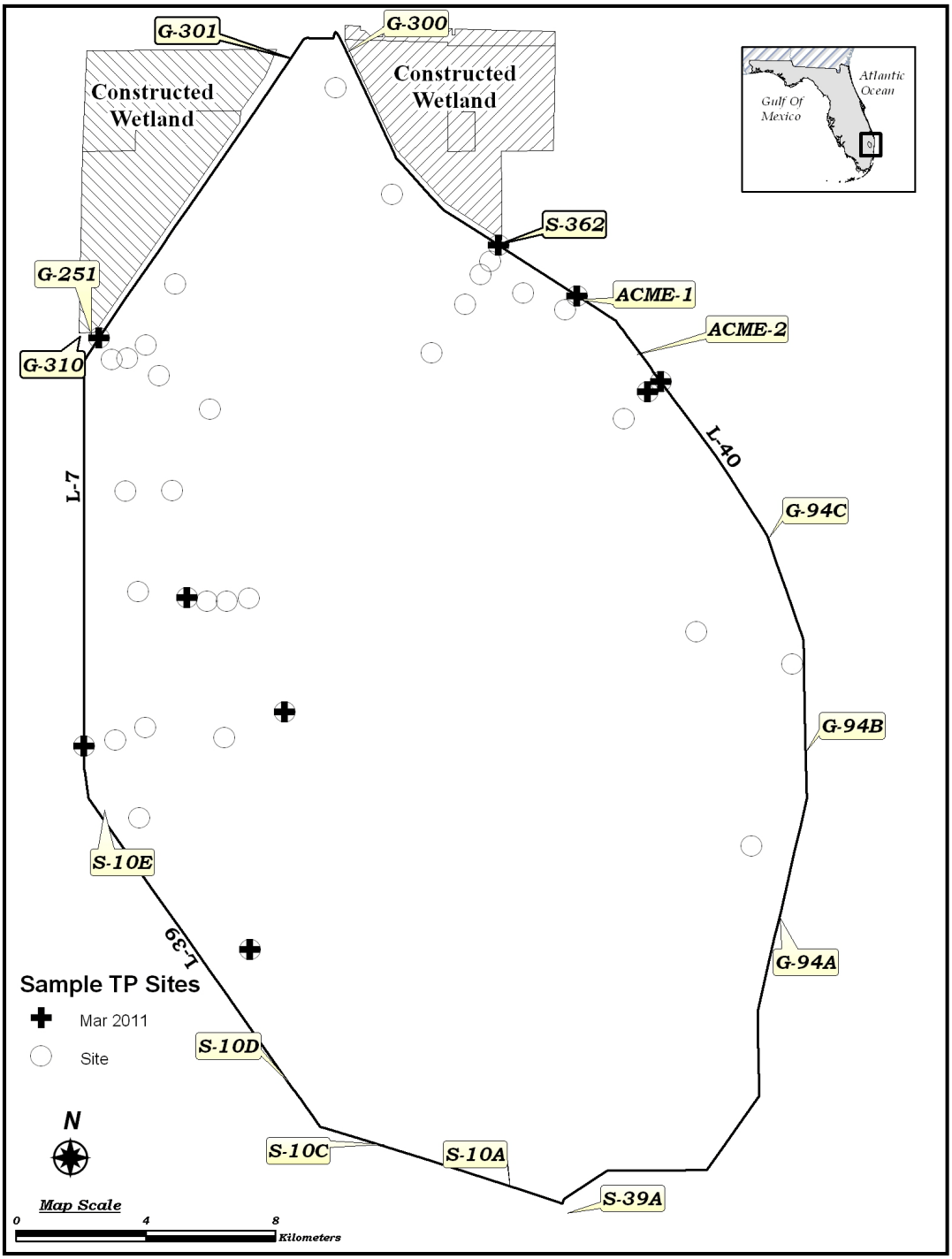

Figure 4. March 2011 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.